Images in Electrophysiology: Multiple Effects of Radiofrequency Ablation

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Introduction

Radiofrequency (RF) catheter ablation is the preferred choice for the treatment of symptomatic reentrant arrhythmias associated with accessory pathways or dual atrioventricular conduction. The mechanism of irreversible tissue injury by the RF catheter ablation is primarily thermally mediated [1,2]. The myocardial cellular electrophysiological effects of hyperthermia muscle have been recently outlined in an in vitro model of isolated ventricular pappillary muscle [3]. This animal study may provide insight into a number of interesting clinical observations made during RF ablation. We report a case involving several effects of RF ablation in a patient with preexcitation.

Case Report

RF ablation was performed during coronary sinus pacing in a 21-years-old man with symptomatic palpitations. The diagnostic procedure before RF ablation revealed the presence of an accessory pathway at the left lateral side. The accessory pathway mediated circus-movement tachycardias. At the first spot with continuous activation during antegrade conduction over the accessory bypass, RF energy was applied at 65 °C. Directly after application of RF energy was begun, four different QRS complexes were observed: a preexcited QRS, a maximally preexcited QRS, a narrow QRS (without preexcitation), and a ventricular extrasystolic beat. Three of these QRS types were induced by the application of RF energy [4].

Discussion

The occurrence of extrasystoles, either in the atrium or in the ventricle, has been observed frequently during RF energy application. There may be several explanations for the enhanced preexcitation of the second QRS complex. First, it may be possible that an atrial extrasystole, originating from a focus close to the bypass tract, is conducted predominantly over this bypass. This explains the small difference in atrial activation between the first and second atrial complexes. On the other hand, when the atrial activation in the first two complexes is similar, supernormal conduction over the bypass may be assumed. During the initial phase of RF energy application, the temperature at the catheter tip increases, which may induce enhanced

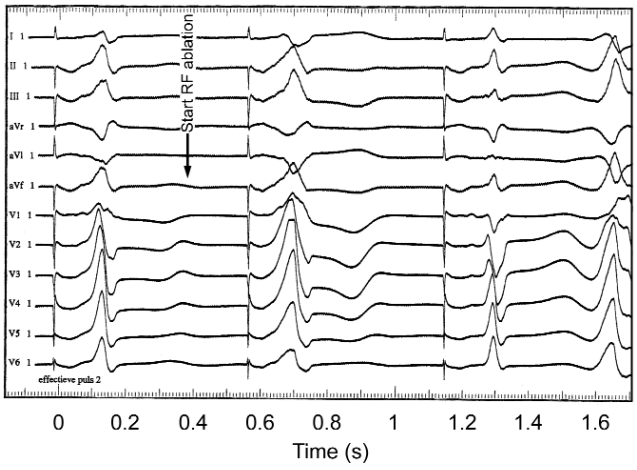

Figure 1. Pacing artefacts are shown before the first, second, and third QRS complexes. Pacing was performed from the coronary sinus during RF ablation. The second complex shows a short interval between pacing artefact and the QRS complex with increased preexcitation, followed by a third QRS complex without preexcitation. A fourth QRS complex without pacing artefact or atrial activity is directly activated at the ventricular site.

conduction through the accessory bundle. The effects of hyperthermia have not been fully delineated, but hyperthermia can increase the slope of the action potential, and has been shown to shorten local activation times in animal studies [5]. A third explanation of the increased preexcitation may be an extrasystole in the accessory bundle itself, which is due to abnormal increased automaticity during hyperthermia [6]. A less probable fourth explanation is the inhibition of conduction over the AV node, which may occur due to RF ablation of the left lateral bypass tracts [7].

Different side effects of RF ablation have been reported, such as transient heart block during ablation at a remote spot of the AV node and His bundle [7], accelerated rhythms [3], or recurrence of conduction after initial successful RF ablation [8]. Interestingly, in some patients recurrence of the conduction over the bypass tract happens only in a retrograde manner, where the conduction was previously manifest in antegrade manner. In this case report, accelerated rhythms were noticed during the start of RF ablation, and the speed of the response is a strong indicator for exact localization of the bypass and sufficient power delivery [8].

References

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